J Orthopaed Traumatol (2005) 6:26–29
DOI 10.1007/s10195-005-0076-1

ORIGINAL

P. Cherubino
D. Prestamburgo
F. Chiodini
M.F. Surace
A. Reggiori

Mid- and long-term results of open discectomy: a clinical study with three to twelve years of follow-up

Received: 2 April 2004
Accepted: 15 December 2004

P. Cherubino • D. Prestamburgo •
M.F. Surace • A. Reggiori
M. Boni Institute of Orthopaedics
University of Insubria
Varese, Italy

F. Chiodini (✉)
Department of Trauma Surgery II
Clinical Institute "Humanitas"
Rozzano, Milan, Italy
E-mail: fchiodini@hotmail.com

Abstract Long-term studies on the results of open discectomy (OD) for the treatment of lumbar disc herniation have shown a high percentage of patients complaining of low back or leg pain and obtaining a permanent disability allowance. We evaluated the clinical results of OD in a consecutive series of patients with 3–12 years of follow-up. A standard questionnaire, containing the Oswestry disability questionnaire (ODQ), was administered to 94 patients who had undergone OD at our institute between 1991 and 1999. A total of 85 patients (55.2%) gave complete information for the study; their mean follow-up was 85.9 months. Forty patients (25.9%) consented to a second clinical examination. The overall mean Oswestry disability index (ODI) was 17.43. At clinical follow-up, 29 of 40 patients (72.5%) suffered low back pain (LBP) with a mean ODI of 21.56. The presence of LBP correlated positively with a higher ODI score. Re-operation was performed in 11 of 85 patients: a 2nd OD procedure was done for recurrent disc herniation in 6 cases and posterior lumbar interbody fusion (PLIF) with posterior instrumentation was performed in 5 patients with disabling LBP. ODI scores in these two groups were respectively 37.33 and 13.2 with a significant difference. Long-term studies on OD have shown a deterioration of the clinical results with time. LBP is the complaint most responsible for a patient's disability. Our study shows that at the mid- to long-term follow-up, OD still provides good clinical results, but also reveals a high percentage of LBP that is related to the onset of a symptomatic insufficiency of the operated disc. These data seem to be confirmed by the significant improvement of ODI after PLIF.

Key words Lumbar disc herniation • Open discectomy • Long-term results • Low back pain

Introduction

Surgical treatment for lumbar herniated nucleus polposus (LHNP) was first described by Mixter and Barr in 1934 [1]. Although there is great debate on the best treatment for LHNP, open discectomy (OD) and removal of the nucleus polposus through an interlaminar approach is a widely accepted technique. Many authors have shown good results at short-term follow-up with OD, with success rates of up to 93%, early return to work and low rates of complications [2–6].

Long-term results after OD, however, are not as good as short-term ones. Hakelius [7] and Nashold and Hrubec [8] compared the clinical results of conservative versus surgical treatment of LHNP with, respectively, 7 and 20 years of follow-up; they found no difference between the groups. Dworak et al. [9] reported data for patients who

had undergone OD with up to 14 years of follow-up: 70% of patients complained of chronic back pain or leg pain, and 14% were allowed a half or complete permanent disability allowance. Weber [10] followed two homogeneous groups of patients treated surgically with OD or conservatively in a 10-year prospective, randomised study: at one year, the surgical group had a significantly better outcome than the conservative group; at 4 years the difference remained significant but to a lesser degree; and at 10 years the difference was not significant anymore.

Recently, Mochida et al. [11] reported an inverse relationship between loss of height of the intervetebral disc, secondary to removal of the nucleous polposus during OD, and the clinical result at the long-term follow-up. Although the efficacy of OD in the treatment of LHNP remains clear, many authors reported concerns about its long-term clinical results. Therefore, the aim of this study was to identify those factors that correlate significantly with a worse clinical result in patients who had undergone OD for LHNP, at the mid-term and long-term follow-ups.

Materials and methods

Between March 1991 and November 1999 154 consecutive patients underwent open discectomy (OD) surgery for lumbar disc herniation at our institute. The surgical technique included the removal of the herniated disc through an interlaminar approach and a limited laminotomy, followed by the accurate removal of the remaining nucleus polposus. Surgery was performed by the two senior surgeons (PC, DP). Information regarding clinical and operative results was obtained from the patients' medical records.

In May 2003, one of us (FC) interviewed the patients by telephone and administered a questionnaire with questions about working capacity, professional situation, compensation and residual low back pain or pain irradiated to the lower limb. Occupational activity was distinguished into 3 categories according to Dworak et al. [9]: light work (office job or white-collar), medium strenuous work (including household tasks) and heavy work (construction workers, blue-collar workers). At the same time, patients were asked to answer to the Oswestry disability questionnaire (ODQ), version 2.0 [12, 13], and we calculated the Oswestry disability index (ODI). The ODI has been shown to be a valuable index of a patient's disability due to back or leg complaint [12, 13]. The index represents in percentage the degree of disability of the patient so that the lower the score, the better is the clinical status.

We were unable to find 60 patients (39%) and 9 were not willing to completely answer the questionnaire. Thus, the follow-up study was performed on 85 patients (55.2% of the initial group), including 48 men and 37 women.

After the telephone interview, patients were invited to a second examination where we performed physical tests, including the straight leg rising test (SLRT) and the cruciate straight leg rising test (CSLRT), searched for any peripheral deficit of strength or sensitivity, and assessed the reflex status.

Comparisons between groups of patients were performed using Student's t test. Correlations between ODI score and the clinical and demographic data were investigated by linear regression analysis. Significance was set for p values <0.05.

Results

We assessed the mid- and long-term outcomes of 85 patients who underwent open discectomy (OD) for lumbar herniated nucleus polposus (LHNP). The patients' mean age was 45.5 years (range, 20–78) with the following distribution: 17 patients (20.0%) were aged less than 35 years; 29 (34.1%) were between 36 and 45 years; 21 (24.7%) were between 46 and 55, and 18 (21.2%) were older than 55 years. At the time of the study, 16 patients (18.8%) were involved in light work, 35 patients (41.2%) in medium strenuous work, 26 (30.6%) in heavy work and 8 patients (9.4%) were not employed. The level of disc surgery was L3-L4 in one patient (1.2%), L4-L5 in 42 patients (49.4%) and L5-S1 in 41 patients (48.2%). One patient only had two levels operated on at the same surgery: L4-L5 and L5-S1.

The mean ODI for the 85 patients was 17.43 (range, 0–68; SD=14.32) at a mean follow-up time of 85.9 months (range, 40–146). We compared the mean ODI of patients with 3–6 years of follow-up (mid term) with that of patients with 6–12 years of follow-up (long term): there was no significant difference between the two groups at the t test (p=0.816). There was no correlation between ODI and patient's age (p=0.25), level of occupational activity (p=0.323) or level of herniation (p=0.31).

Of the 85 patients, 40 (47.1%) gave permission to a second clinical exam. There was no significant correlation between ODI and any of the tested findings: SLRT<45° (R^2=1.8, p=0.471), CSLRT<60° (R^2=0), strength (R^2=2.3, p=0.387), sensitivity (R^2=1.9, p=0.460), or reflex deficits (R^2=0.5, p=0.826). Nine patients out of 40 (22.5%) complained of a persistent sciatica that had never been completely relieved by the surgical procedure; their mean ODI was 32.56 (SD=13.81). Linear regression analysis showed a positive correlation between a higher ODI and the persistence of sciatica (R^2=25.8, p<0.001). Furthermore, 29 patients (72.5%) suffered persistent low back pain (LBP); their mean ODI was 21.56 (SD=14.74). LBP was strongly correlated to a high ODI (R^2=35.4, p<0.001).

Overall, 11 (12.9%) of the 85 patients had undergone re-operation: 6 for nerve root irritation at the same level and side of the previous operation, due to a recurrence of LHNP, and 5 for persistent and disabling low back pain. In the case of recurrence of LHNP, patients underwent a second OD: their mean ODI after the second procedure

was 37.33 (SD=21.28). The other 5 patients underwent posterior lumbar interbody fusion (PLIF) to treat the low back pain. PLIF was performed using two carbon fibre wedges and autologous bone graft anteriorly, in association with a posterior instrumentation with pedicle screws and plates. In these patients, fusion was performed only at the involved level; the decision whether to extend the fusion surgery to just one level was based on findings at magnetic resonance imaging. The mean ODI of these 5 patients at the time of the interview was 13.2 (SD=8.67). Statistical analysis did show a significant difference between these two groups (p=0.043) of revised patients.

Discussion

There is wide agreement that the majority of the patients with LHNP are well managed first through conservative means. Then, if recovery is delayed after such treatment, surgery is considered. Justified indications for surgical treatment have been defined as: the presence of a radicular pain, a positive SLRT <45° or a CSLRT <60° plus two of the following neurological signs: depressed reflexes, paresis and hypoaesthesia [14]. Herron and Turner [15] underlined the importance of assessing the psychosocial attitudes and the economic status of the patient in determining the outcome of the surgical procedure.

Although a number of reports have shown good or excellent short-term results of OD in percentages up to 90%, only a few studies have investigated the mid-term and long-term outcomes of this surgical procedure. According to Dworak et al. [9], up to 50% of the long-term results are considered unsatisfactory. In their revision study of 575 patients with a follow-up of 4–17 years, 70% of patients still complained of low back pain or sciatica and 37% were still undergoing some form of treatment. In that series, 14% of patients were allowed a partial or complete permanent disability allowance.

Weber [10] observed that the long-term clinical results of patients operated on by surgical discectomy were not different from patients treated conservatively, and blamed the "back insufficiency" syndrome as the main complaint determining the disability.

In this study, we investigated the mid- and long-term clinical results of OD on a series of consecutive patients operated by the same two surgeons, with the same technique, over a period of 9 years. The number of patients lost to follow-up was unfortunately high: 55.2% of patients of the completely responded to the Oswestry disability questionnaire (ODQ) and less than 25% of patients were re-examined. Moreover, since this was a retrospective study, a baseline clinical evaluation, with preoperative ODI, is lacking. We are aware that these facts may reduce the significance of the study, but we believe that our experience with this technique over a decade and the results we observed can be of interest for orthopaedic surgeons who deal with LHNP. We chose to use the ODQ version 2.0 because it is a valuable tool in the assessment of disability related to spine disorders, and because it can be easily administered over the telephone [13].

Analysis of entire group showed a mean overall ODI of 17.43. This represents, according to the Roland's normative data for ODI [13], a mild disability level, slightly higher than the weighed mean score of a normal population. The lack of significant difference between the ODIs of patients with 3–6 years vs. 6–12 years of follow-up indicates that the clinical conditions of the patients remained stable within our follow-up period.

We found no correlation between ODI and the clinical findings observed during the follow-up examination; this seems to confirm the importance of the subjective findings in determining the disability level. If a "self evaluation can be more accurate than the clinical, biochemical or physiologic indexes" as Epstein [16] stated, we believe that these data support the validity of the ODQ as a tool to assess a patient's disability.

In our study at the clinical follow-up, 22.5% of patients complained of persistent leg pain and 72.5% of low back pain. Both symptoms were positively correlated with a significantly lower ODI, in agreement with results of Weber [10], Dworak et al. [9] and Mochida et al. [6], who identified in these complaints the main determining factor of disability in patients surgically treated for LHNP.

The fact that only 40 of 85 patients came to a second examination could have biased our analysis. Nevertheless, comparison of the ODI of patients who came for a second examination showed no statistical difference (p=0.20) with that of patients who did not.

Among the patients with residual sciatica, none reported substantial modifications of the complaint over the follow-up time. In our opinion, an irradiated leg pain that remains after primary surgery is to be considered a negative prognostic factor.

We believe that the relatively high percentage of low back pain in our series is related to the surgical technique used: all patients in this study were operated on by herniotomy and complete removal of the nucleus polposus of the disc. Although many authors support the use of this technique to reduce the risk of recurrent prolapse of the nucleus [17, 18], Mochida et al. [11] reported that removal of the entire disc is related to a poor long-term outcome without evidence of a lower rate of herniation recurrence. In their opinion, removal of the entire disc led to instability of the vertebral unit, causing low back pain in the pattern of "back insufficiency".

Eleven patients in this study underwent revision surgery (12.9%): 6 because of a recurrent LHNP and 5 because of a persistent and invalidating low back pain. The recurrence rate (7.1%) is near to that reported by other authors [19] and lower than the 15% that is the international recurrence average defined by White [20]. Patients who underwent revision surgery procedure because of recurrence of herniation showed a particularly high ODI, confirming that recurrence of LHNP and revision surgery are positively linked to a poor clinical result [9]. On the other hand, patients suffering intractable low back pain who underwent PLIF showed a significantly lower ODI. This improvement of the patient's conditions may be related to resolution of the pain due to segmental instability.

We conclude that even if open discectomy still represents an effective technique, with good results in both the short and mid-long terms, a high rate of patients complaining of low back pain is found within the first decade after surgery.

References

1. Frymoyer JW, Donaghy RMP (1985) The ruptured intervertebral disc. Follow-up report on the first case fifty years after recognition of the syndrome and its surgical significance. J Bone Joint Surg Am 67:1113–1116
2. Carragee EJ, Han MY, Yang B, Kim DH, Kraemer H (1999) Activity restriction after posterior lumbar discectomy. A prospective study of outcomes in 152 cases with no postoperative restrictions. Spine 22:2346–2351
3. Schmid UD (2000) Microsurgery of lumbar disc prolapse. Superior results of microsurgery as compared to standard and percutaneous procedures. Nevernarzt 71(4):265–274
4. Hermantin FU, Peters T, Quartararo L, Kambin P (1999) A prospective, randomized study comparing the results of open disc discectomy with those of video-assisted arthroscopic microdiscectomy. J Bone Joint Surg Am 81:958–965
5. Stambourgh JL (1997) Lumbar disc herniation. An analysis of 175 surgical treated cases. J Spinal Disord 10(6):488–492
6. Mochida J, Nishimura K, Nomura T, Toh E, Chiba M (1996) The importance of preserving disc structure in surgical approaches to lumbar disc herniation. Spine 18:1556–1564
7. Hakelius A (1970) Prognosis in sciatica. A clinical follow-up of surgical and nonsurgical treatment. Acta Orthop Scand Suppl 129:1–76
8. Nashold BS, Hrubec Z (1971) Lumbar disc disease. A twenty year clinical follow-up study. Mosby, Saint Louis
9. Dworak J, Gauchat MH, Valach L (1988) The outcome of surgery for lumbar disc herniation. A 4–17 years' follow-up with emphasis on somatic aspects. Spine 13:418–422
10. Weber H (1983) Lumbar disc herniation. A controlled, prospective study with ten years of observation. Spine 2:131–139
11. Mochida J, Toh E, Nomura T, Nishimura K (2001) The risk and benefits of percutaneous nucleotomy for lumbar disc herniation. A ten year longitudinal study. J Bone Joint Surg Br 83:501–505
12. Fairbank J, Pinsent P (2000) The Oswestry disability index. Spine 25:2940–2953
13. Roland M, Fairbank J (2000) The Roland-Morris disability questionnaire and the Oswestry disability questionnaire. Spine 25:3115–3124
14. McCulloch JA (1984) Chemonucleolysis: the state of the art. In: Genant HG (ed) Spine update. Radiology Research and Education Foundation, San Francisco, pp 127–130
15. Herron LD, Turner J (1984) Patient selection for lumbar laminectomy and discectomy with a revised objective rating system. Clin Orthop 199:145–152
16. Epstein AM (1990) The outcomes movement. Will it get us where we want to go? N Engl J Med 323:266–270
17. Deutsch AL, Howard M, Dawson EG et al (1993) Lumbar spine following successful surgical discectomy. Magnetic resonance imaging features and implications. Spine 18:1054–1060
18. Word GW (1987) Lower back pain and disorders of the intervertebral disc. Campbell's operative orthopaedics. Mosby, St. Louis, pp 3255–3221
19. Weinstein J, Spratt KF, Lehmann T et al (1986) Lumbar disc herniation. A comparison of the results of chemonucleolysis and open discectomy after ten years. J Bone Joint Surg Am 68:43–54
20. White A (1984) Overview of and clinical perspective on low back pain syndrome. In: Genant HK (ed) Spine update 1984. Radiology Research and Education Foundation, San Francisco, pp 127–130